

AC 2012-5382: INTERNATIONAL BIOMEDICAL ENGINEERING EDUCATION THROUGH COLLABORATIVE STUDENT SERVICE-LEARNING EXPERIENCES

Mr. Jay J. Bhatt, Drexel University

Jay Bhatt received a M.S. in library and information science and M.S. in electrical and computer engineering from Drexel University. Some of his interest areas include collection development in engineering, outreach to faculty and students, and teaching engineering information research skills to faculty and students. He is the 2010 recipient of the Homer I. Bernhardt Distinguished Service award from ASEE's Engineering Libraries Division and the 2003 recipient of Drexel University's Harold Myers Distinguished Service Award.

Mr. Marko Dimiskovski, Drexel University

Marko Dimiskovski is a B.S./M.S. senior at Drexel University's School of Biomedical Engineering, Science, and Health Systems, with a concentration in tissue engineering and regenerative medicine. He conducts research at the Spinal Cord Research Center at Drexel College of Medicine, involving gait analysis. He is a participant in the Drexel weServe student-run program, which has initiatives in serving health communities local and globally. He has traveled to Mozambique, Africa, as a biomedical engineer serving in a rural hospital during the 2011 summer and is currently a Child Life volunteer at Children's Hospital of Philadelphia. Lastly, he has prospects of going into medicine as a profession.

Miss Vanessa Lin, Drexel University

Vanessa Lin is currently a senior at Drexel University pursuing at B.S./M.S. degree in the School of Biomedical Engineering and Health Systems. Aside from her weServe experience in the Gambia, Lin has also had volunteer experiences tutoring inner-city middle school students within the city of Philadelphia. She has a personal interest in medicine and has participated in the pre-medical volunteer program at the hospital of the University of Pennsylvania.

Mr. Pareshkumar Chandrakant Brahmbhatt, Drexel University

Pareshkumar Brahmbhatt is an undergraduate student of physics, currently in the fourth year. Every year of college included some sort of community outreach through the Society of Physics Students, until Brahmbhatt stumbled upon an opportunity to extend volunteerism internationally through the weServe Program. Brahmbhatt's love for equipment repair came from a robotics hobby that was seeded in high school, but blossomed at Drexel University. Brahmbhatt's former membership in Civil Air Patrol gave the drive to continue giving back to the community even years after the fact. The Drexel University weServe program was able to combine both passions into a single outlet activity which definitely changed Brahmbhatt's life for the better.

Shirin Karsan M.B.E., Drexel University

Shirin Karsan graduated with a master's of bioethics from the University of Pennsylvania's Center for Bioethics. Her research interest is in the cultural and religious perspectives in the ethics of emerging biotechnologies for which she was awarded a Fulbright grant to conduct research at the United Arab Emirates University. She is the Special Projects Manager in the School of Biomedical Engineering, Science, and Health Systems at Drexel University, and Director of the local and international weServe Program, currently established in the Gambia and Mozambique, (Africa), for which the weServe program recently received a student leadership award from the Jenzabar Foundation. She is a summa cum laude graduate from Thomas Jefferson University with a B.S. in diagnostic imaging. She has presented at MESA, the International Conference on Islam and Bioethics in Turkey, the Gulf Cooperation Council (GCC) Youth Camp in Dubai, and on nanotechnology at the 2009 Kenexa World Conference. Karsan also serves as a member of the board of the Global Bioethics Initiative, which concentrates on raising awareness of bioethical issues at local, state, national, and international levels.

Alexa J. Karkenny, Drexel University

Alexa Karkenny, student Co-founder of weServe Africa, traveled to Chicunque Rural Hospital and Maputo Central Hospital in Mozambique in 2009. She has been an active participant in weServe since its inception and has advocated for the program in numerous settings, including at the U.S. Department of State. Karkenny graduated from Drexel University School of Biomedical Engineering, Science, and Health Systems in 2010 with a B.S. in biomedical engineering. She will graduate from Drexel University College of Medicine in 2014 with an M.D., and she aspires to become a pediatric surgeon.

**International Biomedical Engineering Education Through
Collaborative Student Service-Learning Experiences**

Abstract:

In 2009, two students from Drexel University's School of Biomedical Engineering, Science and Health Systems (BIOMED) initiated the weServe Program (weServe). weServe's mission is to provide students with hands-on experiences to utilize biomedical engineering in underrepresented and under-served communities. Since then, student participation in the program has increased and weServe dedicates its efforts to both local and global initiatives, creating partnerships to develop life-saving and life-enhancing solutions through innovative service. With a focus on experiential learning, students are given the opportunity to immerse themselves in communities, learn to identify their needs, and apply their academic educational training in real-world scenarios. On a global scale, the program is expanding and has developed working relationships with hospitals in The Gambia and Mozambique. The progress and efficacy of service projects that students participated in The Gambia and Mozambique will be analyzed. Additionally, the impact in gaps of service visits, due to academic schedules and lack of financial resources will be discussed and the status of biomedical engineering in The Gambia and Mozambique will be referenced.

Introduction:

A 2009 WHO report¹ states the following: Our analyses suggest that workforce shortages in the countries under study are even more alarming than suggested by the existing literature. Not only are current numbers insufficient to meet health needs but in at least 6 of the 12 countries, pre-service training is insufficient to maintain absolute numbers even at their current levels. Boosting pre-service training is clearly important but is a longer-term solution because putting in place the infrastructure (human as well as physical) that is needed in these countries will take a long time. Hence, a variety of complementary, shorter-term responses must be considered. For instance, shifting some tasks from people requiring longer-term training to those requiring less intensive training will enable more services to be made available in a shorter time.

weServe aims to bridge the gap that exists between the developing world and others by providing service, time and donated educational material. Future work will involve advancing towards cloud-based services with Drexel Libraries. This partnership will help impart information-gathering research skills to students through face-to-face and virtual consultations; online tutorials, instructional sessions, and providing research help as needed. It will enable an increase in accessibility of educational resources in healthcare, hospitals, and engineering instrumentation in addition to biomedical engineering related work by students and hospital staff alike. In turn it will decrease discontinuity between on-site visits, allowing the host hospitals to keep up with current trends in education and narrow the disparity between the developing and developed countries. The weServe international engineering service learning program has presented immense opportunities for students to develop international research partnerships as well as projects in biomedical engineering that can be translated to low income and low resource communities.

The weServe Program:

Students in Drexel BIOMED initiated the weServe, “Service through Innovation” program². Following a freshman class (University 101), which required several hours of civic engagement, the students felt compelled to serve further, and chose to go to The Gambia and Mozambique, to identify needs that could be met by biomedical engineers. This led to meeting leaders in the health care field, who were extremely impressed by the potential of the students to contribute to rural locations in a way that had never been done before. Students proved their worth by assessing and restoring biomedical equipment that was desperately needed but not functional, since there was no availability of expertise in the field of biomedical engineering².

Upon their return, the students inspired others to serve by using their academic training in areas where their knowledge and expertise could be applied to real world scenarios. Since then, the program has expanded, student participation has increased, both locally and internationally, as illustrated in Table A: ² and is now more formalized.

	The Gambia	Mozambique	Local weServe (Philadelphia and PA region)	Total # of participating weServe Students
2009	2	2	4	8
2010	4*	0	11	15
2011	3	1	16	20
2012	8	4 (anticipated)	39	51

Table A: weServe student participation 2009-2012 (*3 students and 1 faculty)

Students wishing to experience international service learning must first serve locally. There are several major reasons for this:

1. The service experience must begin at home to fully comprehend and appreciate the needs and resource restrictions in students’ own domestic environments, which need addressing. Local sites that weServe has partnered with include low resource community clinics in inner city areas, communities where there are people of different abilities (neurological disorders, physical challenges, minority groups, and vulnerable populations in diverse socio-economic groups and varying educational backgrounds).
2. The weServe experience involves immersion into the community that students choose to serve. It is only when they spend enough time to work with and understand the community, that they can identify the needs in that community, and work in partnership so that members of the community they serve can be empowered to drive changes that will benefit them.
3. The community members in turn will be trained to also deliver solutions as needed, and aim to help build local capacity for basic biomedical engineering skill sets.
4. Students bring back these experiences to academia to further develop their ideas into their freshman, junior or senior design projects (or master’s thesis), with potential to provide solutions for the community they served, and society at large.
5. Students achieve an additional dimension in their academic experience. By working with the local community, they acquire a sense of appreciation for the value of service, and decide

whether they are ready to take the next step to go internationally, in extremely resource poor settings, with many limitations, and immerse themselves in a new and very different culture, with language restrictions and often very little power available, thus further challenging themselves personally.

6. Students will gain awareness of different cultures, which in turn will increase mutual understanding among societies, enabling them to become better global citizens and positive contributors within global markets.

To maximize the international experiences, and enable efficient usage of their time and skills, the students are trained at Drexel University for at least six weeks prior to their departure to the African site locations. The Biomedical Engineering department lab manager provides this training, which involves building upon each prior student's experience abroad. Students take inventories of medical equipment available at the sites. Each piece of equipment is classified with the categories listed in Table B.

Student Name	Date of Assessment	Hospital Technician	Staff Name
Equipment Description	Location	Problem Description	Parts Needed
Equipment Manufacturer	Model	Serial #	Fuse Info
Circuit Breaker	Date of Service Performed	Photo ID #	Final Equipment Status

Table B: Information documented per piece of equipment

Reports are generated from the inventories that students provide, and through continuous contact with their site hosts and the technical staff they track the status of the equipment. The lab manager reviews the reports and helps anticipate the needs of the next team of students going to the site. Training includes exposure to as much equipment as possible, based on the latest inventory at the African locations.

To enhance this training, the weServe program also partners with local hospitals and their clinical engineering departments. Students have the opportunity to shadow the clinical engineers, who help the students understand the mechanical and technical aspects of equipment repair. In addition, students get a sense of prioritizing needs within, for example, a pediatric unit. Most importantly, they learn about their limitations and knowing what equipment they must absolutely not tamper with, such as X-ray (high voltage) units, or those where bodily secretions may be of concern for health and safety reasons. Students state that having the opportunity to work with real-life settings and be under the supervision of trained engineers as they explore the world of bioengineering at a professional level is extremely valuable. Exposure to equipment in its normal, functional, and non-functional state is a great hands-on, rewarding experience, particularly for those who have been focused on primarily classroom or lab-based, scientific research experiences. Taking this experience to another level, students begin to understand the implications of biomedical equipment sustainability in the developing world and the challenges that limited technological resources pose for efficient health care delivery. As students realize that the extent of care physicians and nurses can provide in resource-poor settings is often

limited by the tools and supplies at their disposal, students can envision the rewards of their skills in action. For instance, without sufficient autoclaves, adequate sterilization of surgical supplies cannot be ensured; without diagnostic tools such as a cell counter, progression of AIDS cannot be monitored; and without a functional scope a particular surgical approach cannot be utilized. As witnessed at Chicique Rural Hospital in Mozambique, a scarcity of functioning incubators may compromise the health of newborns. Hence, it is an undoubtedly gratifying and humbling experience when a baby is placed into an incubator soon after a student has restored it. In this way, a weServe experience provides students, as future biomedical engineers or other health professionals, a unique platform from which to address health care disparities in the developing world, with a practical perspective on how to tackle such disparities through collaboration and innovation.

Student experiences in The Gambia:



Drexel University weServe students in Banjul, The Gambia

Students have been going to The Gambia since 2009. Three weServe students volunteered in The Gambia from May through August of 2011, five months after another weServe student's return in 2010 from the Sulayman Junkung General Hospital (SJGH), which serves a population of approximately 100,000; inclusive of the towns surrounding Bwiam^{3, 4}. Staffed with nurses and Cuban physicians, SJGH's facilities include an accident and emergency (A&E) department, which is accessible 24 hours, 7 days a week³. The hospital also has outpatient wards, dental clinic, and an ophthalmology clinic³. Additional facilities offered within the inpatient department include medical, surgical, maternity, and tuberculosis wards³. weServe has established a relationship with SJGH since 2009 and has had seven Drexel University students and one doctor dedicate their services continuously since then. In summer of 2012, eight additional students will be volunteering in The Gambia.

weServe is now sending interdisciplinary teams to participate in the service-learning experience. The most recent team included one student from BIOMED and two students from Drexel University's Physics department. This collaborative effort included training in basic troubleshooting methods appropriate for non-high voltage medical electronics, mechanical disassembly, component function identification, electronics soldering, and comprehension of technical documentation. Collectively, the students assessed and restored a multitude of equipment, including but not limited to the itemized list in Table C.

<u>Equipment</u>	<u>Location</u>
Ablation machine	Operation Room
Defibrillator	Emergency Department
Heart Monitor	Emergency Department
Pacemaker	Emergency Department
3 Analog weight scales	Pharmacy
4 Electronic Weight scales	Pharmacy
2 Suction Pumps	Medical Ward
4 Oxygen Concentrators	Medical Ward
2 Microcentrifuges	Laboratory
Otoscope	Outpatient Department

Table C: List of equipment serviced and their location within the SJGH

While the focus of the volunteer work at SJGH was to assess and repair medical equipment, the students partook in many other tasks and projects. These tasks included providing Information Technology (IT) services for setting up a virtual library, holding various training sessions for hospital staff, as well as organization of literary material for SJGH's medical library. The weServe students supplied the SJGH virtual library with 8 tablet laptops that were donated by Drexel University (College of Medicine). The students also repaired and set up anti-virus protection software on 10 computers in the recently established medical school. They also assessed and expanded the original network infrastructure from just 2 wireless access points to a total of 6 access points. They trained the hospital staff and 9 medical students on their work and personal computers. Basic computer training sessions covered word processing, spreadsheets, PowerPoint, file management, e-mail communication, and typing. Improving typing skills was a specific goal for many of the hospital staff, which inspired the weServe students to install typing tutor software on all of the 18 computers located in the hospital.

Access to Internet-based educational resources was sporadic due to the limited reach of the nationally established electric grid infrastructure, as well as a lack of locally wired connections to Cloud-based services. Approximately 20 gigabytes of digital educational content was acquired to allow staff and medical students to have off-line access to text and videos on subjects of interest ranging from the Core Sciences of Biology, Chemistry, and Physics to the Computer Sciences of Informatics, Computer Architecture, and Programming. Internet access was only available in spurts, as the weServe students experienced during their stay at the SJGH. All other times, there would be insufficient or no electricity available for leisure activities such as using a computer, cooking, reading by lamp light, using an electric kettle to brew tea, or any purpose. The sporadic nature of electric power availability was dependent on how much fuel was available for supplying the ambulances and generator, and if the solar panel array collected enough power the day before.

The students conveyed their knowledge of library organization and cataloging processes with the hospital librarians. This was an ongoing project, which was started by the student who had volunteered five months prior. The status of the library from the time between the weServe students' visits was encouraging. The librarians had manually cataloged all the books within the library and had begun the process of storing those books electronically on a laptop reserved for

librarian use. However, the weServe students also found approximately 360 books donated by the organization Books for Africa and were successful in organizing, electronically cataloging, and placing all books in the hospital library. Some of these donated books were allocated for the secondary (high) schools in the local village of Bwiam.

The BIOMED student focused on clinical activities within the hospital participated in SJGH's weekly community outreach service called Trek with a team of five nurses and two laboratory technicians to provide healthcare services in the nearby satellite clinics. The weekly Trek is a service through SJGH in which the hospital sends out a team of nurses and lab technicians to health clinics in the region. The purpose of Trek is to reach out to the health clinics where patients may be too far from a primary care facility such as SJGH. The locations where the Trek team visits vary in distance, anywhere from 15 minutes to almost 40 minutes drive via an all-terrain ambulance. There are at least eight Trek locations, which the team rotates through on a monthly basis.

The weServe student from BIOMED found great opportunity to observe surgeries conducted by a Cuban surgeon, who is one of the only two surgeons in The Gambia. Both the Trek and the on-site surgeries were highly valuable for the weServe student as it provided a diverse view on the delivery of health care. In addition, the weServe student also participated in a brainstorming session with the HIV/AIDS support group at SJGH. At these sessions, the locals discussed, with the group coordinators, the difficulties of living with the disease and how to cope with the social, personal and health issues. The leader of the support group advocated the need for education and the dissemination of knowledge related to HIV/AIDS in order to combat the stigma that these individuals face due to their cultural environment.

Sharing knowledge and information goes beyond the HIV/AIDS support group at SJGH. As mentioned earlier, by installing typing tutorials and providing advice on proper equipment usage to the laboratory technicians for instance, it is evident that the weServe students have created meaningful relationships with the hospital staff in terms of shaping, learning and developing channels of flow of information. On an anecdotal note, a Cuban doctor had approached the students with a heart defibrillator and described that the machine was originally on their ambulance but now was non-functional and wanted to inquire if the weServe students would be able to fix it. The trust and faith the doctor showed in the students was humbling and demonstrated the positive relationship that grew between the students and the hospital staff; regardless of their status as Gambian or Cuban. Moreover, the weServe students were able to experience the impact of their role as biomedical engineering students.

There were many situations that presented themselves as learning opportunities during the students' stay in The Gambia. For example, there was a technical problem that arose just before surgery, halting the whole process. At SJGH, surgery only occurs once a week under the condition that a Cuban surgeon is available and there is transportation to pick him up. It was a Thursday, there were several surgeries lined up, and approximately an hour prior to the first surgery the generator supplying power to the operating rooms stopped functioning. Quickly, the weServe students joined with the SJGH maintenance team to troubleshoot the situation; without power the operating rooms would be without a working anesthesia machine and room lights. After several hours, the students, with the maintenance team, jumpstarted the generator using a temporary bypass method to get the fuel around the pump and into the combustion chamber.

Fortunately, surgeries were able to commence shortly after. This event was moving as it presented the students with a situation on how to deal with the unknown and how to collaborate in order to quickly resolve a predicament. It became more than a “hands-on” experience as it became an engaging learning experience exemplifying that fixing one piece of equipment impacts subsequent processes.

Two of the weServe students got the chance to visit another hospital located on the Northern shore of the river Gambia. They went to the AFPRC General Hospital in Farafenni. This was at the request of the CEO of AFPRC General Hospital, stating that they were in need of engineers. The two weServe students gladly went to their aid. By chance, the hospital’s only ocular lamp had stopped working the day the students arrived. This wasn’t a simple bulb replacement, but the previous lamp bulb had melted the wire contacts off. The students, who bring their own tool kits, had the only soldering iron in the hospital. Their arrival allowed the patients who had been waiting to be prepped for surgery to receive their cataract surgery.

Prior to the students’ arrival, most of the computers in SJGH did not work properly, and were placed out of the way. The students returned the machines to working order, and showed the staff how to take preventative measures in order to keep the machines up and running for a longer length of time. This forced the students to learn patience as well as how to convey ideas in an understandable manner. Language and cultural barriers had to be overcome, and facing these cultural challenges was a moving and valuable learning experience.

Student experiences in Mozambique:



Drexel weServe students in Maxixe, Mozambique

In 2009 two students from Drexel University visited Chicupe Rural Hospital (CRH or HRC) located in the city of Maxixe in the Inhambane province of Mozambique, Africa to serve as biomedical engineers. The CRH has a 200-bed capacity and serves over 500,000 patients from the surrounding cities in the province. There are 5 physicians, 13 medical technicians, and 48 nurses who work at the hospital⁵. Two years after the initial student visit, another BIOMED weServe student served in Maxixe from June to August 2011. This gap was primarily due to lack of resources for the high cost of travel to and housing in Mozambique. Since there was a long period of time between visits it was difficult to assess the issues and needs of the hospital and community, and compare it to the 2009 visit. Although the primary language in Mozambique is Portuguese, many people, particularly the technical staff and doctors, speak English, enabling communication. The first step was to reconnect with the hospital staff to establish a stronger relationship between the students and the hospital. This was essential for acknowledgment of the needs and issues. A full assessment of biomedical equipment was done, with identification of the

working status of the equipment, and which hospital staff members used it. Restoration of the equipment of highest priority, according to the staff's needs, was done in conjunction with teaching the staff how to use, maintain and obtain general guideline steps to repair the equipment.

From the initial students' visit, it was apparent that biomedical engineering was not a prominent, practiced field within the hospital. The subsequent student connected with much of the personnel who used the biomedical equipment. This reconnection was welcomed by the staff, enabled teamwork for the restoration process, and allowed the staff member who directly used the equipment to learn to better operate, maintain and repair the equipment. Reconnecting with the hospital staff was extremely important, but it also led to connecting with other surrounding hospitals to establish points of contact for future endeavors, efficiency and availability of equipment, and sharing and exchange of hard-to-find items and parts between hospitals. Recommendations were made during a brief tour of each hospital for negotiations in the future for stronger ties and communications between each hospital.

Connections were made between:

- Chiquique Rural Hospital (CRH)
- Cambine Clinic
- Inhambane Provincial Hospital (IPH)
- Maputo Central Hospital (MCH)

Some hospitals were better equipped than others. For example, IPH and MCH had extra equipment on site and a wider array of equipment, whereas the Cambine clinic had the essentials for a limited set of procedures. If a patient were initially taken to the smaller hospitals like Cambine or CRH and the case could not be handled there, the patient would have to be transferred to the larger hospitals in the chain (MCH).

An assessment of all biomedical equipment was done throughout the hospital during the seven-week stay. Information about the manufacturer, model, location, and status of the equipment was recorded. Each machine was tested to evaluate proper condition and working order. Operations and maintenance manuals were also gathered if possible. Much of the equipment was stored in a basement of the hospital where donations would be stored until proper assignment to location, or if the equipment seemed to be in need of repair. The inventory list created was used in the organization of equipment to its proper departmental location and priority of repair with input from the staff. Priority of repair was mainly determined by searching for areas of high traffic for use of the equipment. Table D is a list of equipment that was restored through teamwork between the weServe student and the local staff.

<u>Equipment</u>	<u>Location</u>
3 Vital Signs/anesthesia monitors	Consultation
Oxygen Concentrator	Surgery
3 Defibrillators/heart pacers	Consultation
Surgical lamp	Basement- for backup
Dental cart	Dental
Air compressor	Dental

Anesthesia system	Surgery
Infant bed warmer	Maternity
X-ray light box viewer	Radiology

Table D: Examples of the type of equipment fixed, and its location

The main challenge in the restoration process was obtaining parts that were specific to the equipment. For example, six vital sign monitors were missing cables essential for operation, but these were very costly to obtain locally. Other parts were salvaged from old nonfunctioning equipment, found in local markets or were improvised, such as making power cords or rewiring of circuit boards. On numerous occasions the student experienced (more) emergent calls from the staff. One such instance was a leak in a tube of the only functioning dental instrumentation set. With a crowd of patients waiting the student was able to intuitively overcome this problem by shortening the tube to dispose of the leaky portion. It was through completing these tasks that the student realized the high value of pre-training at Drexel University and shadowing at the local hospitals in Philadelphia, since many of the necessary techniques were obtained by training with the clinical engineering staff and the experience of shadowing them.

The CRH hospital staff, such as the anesthesiologist, worked closely with the student teaching him what the proper operation of a specific anesthesia machine should be. With this advantage, and a biomedical engineering background, the student was able to restore a previously inoperative anesthesia system to its full function. This enabled the staff to perform two surgeries simultaneously and have an extra anesthesia system for emergency backup, exemplifying effective experiential learning and a highly beneficial outcome to the medical community.

Although assessment of the CRH's equipment status, and repair of biomedical equipment was a primary objective for the visit of the student, other areas of interest were touched upon. The university had provided two donated laptop computers, for which the student loaded open source software (Ubuntu Linux; <http://www.ubuntu.com/>) and recommended adding OpenMRS (<http://openmrs.org/>) software, rather than proprietary software. In his opinion, Linux provides a stable working platform with better security avoiding intrusive viruses and spyware compromising the system and it's data, and would be cost effective. This also generated interest among hospital administrators at CRH for restructuring the current paper based registration system at the hospital. The eventual integration of an electronic medical records system would provide better statistical data and medical records management. These recommendations were based on day-to-day observations of the hospital's operation, and comparing it to the more efficient management of the hospitals in Philadelphia, also observed during the student's training phase in the weServe program.

Several visits were made to the Center Of Hope, a community public health project outside of the hospital, to learn about public health measures taken in Chicuque and beyond. Information and data regarding ongoing and future projects were gathered. The student was able to participate by observing and traveling with the health promoters of The Center Of Hope. The promoters traveled to more remote areas, each teaching about important healthy practices with a different focus depending on the major problems in the area. The weServe student was also able to observe laboratory and surgical procedures.

The two previous students left behind posters of guidelines for microscope use in the laboratory, which was still in use for ongoing maintenance. The student also noted posters and procedures notes from the past students, in the other hospitals and in the laboratory department. However, an infant bed warmer that was documented as restored was out of service on the most recent visit.

Reflections:

Our recent expeditions to The Gambia and Mozambique have confirmed the African Health Care Worker Shortage about which Jeff Collins⁶ has written, stating that the dire need for health care services that many African countries are currently experiencing is one that has begun to receive much more attention from developed nations, as well as international organizations, and that while there is, of course, a need for this type of relief, a lack of access to medications and proper disease prevention tools plays a major role in the disproportionately large burden of disease seen in Africa. The problem, however, is that there are no complimentary investments being made in health care infrastructure. The most acute of these infrastructural shortfalls is the lack of health care workers.

Observations made by weServe students in both Mozambique and The Gambia demonstrate that documented procedures and guidelines helped sustain maintenance practices for longer periods of time, but it is difficult to provide better hands on learning when there are significant lengths of time between student service visits. Most importantly though, the student was able to see the impact of his work when he observed that the anesthesia machine he had repaired was used on several surgeries. The service-learning platform has been a great avenue to fill the gap for the current shortage. Through volunteering, students are empowered to apply their academic education and use their resources among communities where there is a shortage of skills and manpower. By volunteering their time, skills and services these students become valuable teachers among communities who welcome their knowledge. Often students continue to give of their time even after they arrive back in their academic institutions, often via electronic communications such as email, Skype or Facebook.

The impact that these communities of scarce resources have had on the students who volunteer not only leaves students with a profound awareness of the value of their contributions, despite their own experiential limitations, but in fact increases their desire to encourage and motivate others to contribute in ways to overcome and narrow the gap of global disparities.

weServe collaboration with Drexel University Libraries:

Students participating in this program need a variety of information during the course of their different projects.⁷ Whether they are looking for information on health statistics, country information, cultural and sociological information or technical information about their medical technology, the collaborative partnership with Drexel University Libraries in assisting them to locate this information, will play crucial roles in their successful accomplishments of variety of tasks. There are a number of ways in which participating students can receive research help that they need for their projects.

Face to face research help:

Students can contact librarians by making an appointment or to simply ask for help at the reference desk in the Library. Through verbal dialog and interaction, librarians understand their information needs and will recommend appropriate resources they can use.

Electronic Mail Reference:

Students can email their questions to the Librarians. Librarians recommend appropriate sources to help them find information they need. An advantage of this service is that students receive their response in email as a written document and therefore, can refer to it at a later date and use for other class assignments and projects. They can also go directly to the web resource if the web address is included in librarians' email response.

Chat reference:

With live chat reference, students can ask any questions. They receive responses and research help at the same time through virtual chat service. They can also save their chat transactions with resources included so that they can refer to their transactions at a later date when needed.

Library Website, Research Guides and Blogs:

Through a discovery tool such as Summon students can be able to discover content from journals, newspapers, books and other resources quickly. Engineering librarians created two blogs to highlight core electronic resources and useful searching tips for core engineering related databases. These blogs can be accessed either through the University Libraries' website, Engineering Librarian's web page, or simply by searching in any Internet search engines. The two blogs are: EngLibrary and Engineering Library Instruction. EngLibrary blog provides access to Web and electronic resources to help students keep current with engineering information. The Engineering Library instruction blog provides tips and links to online tutorials on how to use different databases more effectively and efficiently. Students needing information on how medical instruments work can refer to the blog post on Biomedical Instrumentation available from the Libraries' web site. Here is an example of a partial screen shot of a blog post of Biomedical Instrumentation class:

BMES 391 – Biomedical Instrumentation I

Click on the links below to see what books are available in the library in some key areas related to Bioinstrumentation

- [Bioinstrumentation](#)
- [Biomedical Engineering Instrumentation](#)
- [Medical and Instrumentation](#)
- [Sensors and Handbook](#)
- [Biomedical and Devices](#)
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Electronic Books

Click on the links below to access electronic books (Access only to Drexel faculty and students)

- [AccessMedicine](#)
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- [ebrary](#)
- [Electronic Lectures on Biomedical Mechanics from Synthesis Digital Library](#)
- [Encyclopedia of Biomaterials and Biomedical Engineering](#)

Students needing information on health statistics and data can refer to the Statistical Resources research guide, navigate through various resources and explore them to find needed information.

See below for an example of a partial screen shot of Statistical Resources Research Guide:

Statistical Resources

- [Census Data](#)
- [Demography & Population Studies](#)
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- [State and Local Statistics](#)
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- [Health Statistics](#)
- [Market Research & Industry Statistics](#)
- [Additional Statistics Resources](#)

Census Data

[US Bureau of the Census](#)

[Census 2000 Gateway](#)

[Census Data for the United States 1790-1960](#)

Online video tutorials and Instructional sessions:

Drexel University Libraries' website provides access to several online video tutorials that students can access anytime from anywhere. Students can refer to these tutorials and learn how to find information using these virtual tutorials. Librarians also provide face-to-face instructional sessions to several students in a class or individual and small group consultations. In brief, Libraries provide number of services to help students working on their projects relevant to the weServe initiative. Ultimately, it enhances the quality of student learning, and students can complete weServe projects successfully from wherever they are.

This is particularly useful when developing distance-learning programs for our international partners. On-going and continuous support can be provided remotely as and when needed, with students also feeling empowered by getting support from libraries, which in turn can be used for training purposes in Africa or anywhere else that a need is identified.

Collaboration with University Libraries provides an important educational forum for students to help locate information they need for various projects as part of their weServe experience.

Future vision and marketing the program:

Given the interest generated from various schools and colleges around the university, the weServe program has now evolved into an interdisciplinary approach. Students from the School of Public Health, Nursing, College of Medicine, the School of Information Science and Technology, School of Education, College of Engineering, and the Biology and Physics departments have all shown interest in the international programs. We believe these disciplines should also be integral to the way a community can be assisted. Based on the examples cited of

our students' experiences in The Gambia and Mozambique, it is evident that there is room for any student to participate and contribute to society through this service learning experience through the weServe program.

Currently, the program is promoted through various channels via the school newspapers, brochures, websites and social media such as Blogs and Facebook.

Our vision is to send multidisciplinary teams to international locations. Based on the success of our programs in The Gambia and Mozambique, we have had requests to send students to other, additional locations within Africa. Students from diverse backgrounds can provide services in various ways and make a great difference in these low resource communities. Additionally, sending a multidisciplinary team provides the opportunity for the students to learn additional skills from each other and work in ways that they do not necessarily have the opportunity to do in academia, thus adding another dimension to their educational experience. This cycle (Spring/summer 2012) we are sending a multi disciplinary team of eight students to The Gambia. This team will consist of biomedical and chemical engineering undergraduate students as well as public health graduate students, who will all work together in projects identified within the health care facilities and rural communities that they will be serving.

To date, Drexel University and some partner organizations have supported the weServe program by funding our students' travel and related expenses. The program recently won an award for student leadership, through the Jenzabar Foundation⁸, from which additional funding was provided. Our challenges are to fulfill the needs of all these locations that seek our help. More importantly, we seek to enable and empower them to sustain their own communities, so weServe can move on to continue its work in other locations in need. Although students achieve academic credits for their service experiences abroad, we cannot financially support enough students to meet all the requests we get. We continue to seek ways to do so, by applying for grant assistance, and hope that we will be able to do more so that many more students and communities can also gain from this incredible experience.

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